MRID No. 414504-01

DATA EVALUATION RECORD
LIFE CYCLE FISH
GUIDELINE 72-5
DP Barcode D209094

1. **CHEMICAL:** ^{14}C-Cyfluthrin (Bythroid) **Chemical Code:** 128831

2. **TEST MATERIAL:** Technical **Purity:** 99%

3. **STUDY TYPE:** 72-5 Fish Life Cycle Toxicity Test.

4. **CITATION:** Rhodes, John E. et al, 1990. Full Life-cycle Toxicity of ^{14}C-Cyfluthrin (Bythroid)to the Fathead Minnow (*Pimephales promelas*) Under Flow-Through Conditions. Conducted by Analytical Bio-Chemistry Laboratories, Inc., Columbia, MO. Submitted by Miles Inc. Report No. 100097. **MRID No. 414504-01.**

5. **REVIEWED BY:**

Alvaro Yamhure, Biologist
Ecological Effects Branch (7507C)
Environmental Fate and Effects Division

Signature:
Date: 1/24/95

6. **APPROVED BY:**

Norman J. Cook, Section Head
Ecological Effects Branch (7507C)
Environmental Fate and Effects Division

Signature: Norman J. Cook
Date: 01.25.95

7. **CONCLUSIONS:** This study is scientifically sound and meets the guideline requirements for the Life Cycle Toxicity test using the Fathead minnow. The MATC for Cyfluthrin (calculated as the geometric mean of the NOEC and LOEC was determined to be 0.19 ug/l). The NOEC was 0.14 ug/L and the LOEC was 0.25 ug/L. The 96-hour LC_{50} was determined to be 2.49 ug/l.

8. **MAJOR GUIDELINE DEVIATIONS:** There were no significant deviations from the protocol used (EPA-600/8-81-011 of May 1982) that may have affected the validity of the test.

9. BACKGROUND:

10. DISCUSSION OF INDIVIDUAL TESTS: N/A

11. MATERIALS AND METHODS:

A. Test Animals

Newly fertilized eggs of Fathead minnows (less than 24 hours post-fertilization) were obtained from U.S. Fish and Wildlife Service, Columbia, MO. The eggs came from 8 spawns by 11 breeding pairs. The eggs at ABC Labs. were then placed in incubator cups (35 per cup). The embryos resulting from these fertilized eggs formed the stocks for two generations of testing for survival, growth and reproduction.

B. Test System

Two modified continuous flow diluters were used for testing under flow-through conditions. One diluter was used for embryo and fry exposure and the other was used for adult fish through the reproductive stage of the study.

For the first 113 days, the diluter delivered to replicate hatching/growth chambers at and average rate of 88.7 liters/replicate/day . The duplicate spawning aquaria were added on day-112 with a volume each of 48.5 L and each was subdivided with stainless steel mesh into 4 spawning compartments designed to maintain the solution at a maximum depth of 23 cm. From day 113 to the end of the study on day 307 duplicate spawning aquaria and replicate hatching/growth chambers received test solutions at an average rate of 687.9 liters/day.

Test chambers were maintained at 25± °C in a thermostatically heated water bath for duration of testing. Photoperiod was varied to represent a United States type photoperiod. Light intensity at the surface from wide spectrum fluorescent bulbs was about 138± 25 footcandles A 15 minute transition period was used to simulate dawn and dusk. Test water was obtained from uncontaminated deep well water and the hardness adjusted by reverse osmosis and mixing to 24-28 mg/l of as CaC03 and a Ph of about 7.5.

C. Dosage

Based on preliminary tests conducted, nominal concentrations for the definitive tests were selected as 0.016, 0.031, 0.063, 0.13, and 0.25 ug/L. The mean measured concentrations measured by scintillation counting were 0.018, 0.033, 0.065, 0.14 and 0.29 ug/l.

D. Design

The study was defined in three phases, F_o, Reproductive, and F_1.

The F_o phase of the study was begun by impartially placing 35 fertilized eggs into incubation chambers. Additional embryos were added until each of the four replicate chambers for the two controls and the five test solution chambers contained 35 eggs each. Fry were released from the egg cups into the growth chamber in day 7. After hatch adverse effects were recorded in all chambers **(validation of the F_o generation survival by the EEB reviewer is attached to this report)**.

Feeding began on day 4. Fish were fed live brine shrimp and a commercial fry starter feed during testing.

Following hatching, 25 fry were transferred into two retention chambers. Growth was determined by the photographic method of McKim and Benoit on study days 36 and 67. On study days 96, 126 and 307 growth as determined by standard length and wet weight was determined. At 61-days post-hatch fish numbers were reduced from 25 to 15 per replicate and to 10 at 120-days post-hatch, for the **reproductive phase**, some of the remaining adults from chambers A and B combined to give chamber E and chambers C and D combined into chamber F. Once sexual secondary characteristics became apparent (153-day post-hatch) four spawning pairs were randomly assigned to each replicate or eight fish per concentration.

Eggs resulting from the above mating pairs were divided to be used in residue analysis, others were allowed to develop further and hatch and were also frozen for residue analysis. Other eggs, in groups of 35 were placed in unoccupied hatch/growth chambers to be used in the determination of hatchability and, after reduction to 25, were used to measure F_1 survival and growth. Some eggs were used to determine a 96-hour dynamic LC_{50}.

E. Statistics

One-tailed Fishers Exact Test and frequency analysis were use to compare hatchability and survival data. Solvent and blank control data were pooled if a t-test showed no significant difference. Growth data was examined by analysis of variance adequate for nested data. Dunnett's one-tailed multiple comparison procedure was used to analyze between the treatments and the controls.

Five parameters were used to indicate success in spawning: spawns/pair; number of eggs/pair; eggs/spawn; number of

reproductive days and number of eggs/pair/ reproductive day. Analysis of variance of the spawning success data was conducted at the $P \leq 0.05$ and 0.1 levels of significance and this procedure was followed by a non-parametric procedure coupled with a Wilcoxon rank-sum for testing that a distribution of a variable was the same across all concentrations. SAS/STAT release 6.03 was used to conduct the computerized statistical analysis.

12. REPORTED RESULTS

Mean measured concentrations were 0.018, 0.033, 0.065, 0.14 and 0.29 ug/l representing 100 to 116% on nominal.

Hatching Success

In the F_0 phase of the study, percent hatch ranged from a low of 75.7% in test level 2 to a high of 92.1% in test level 1 with no statistical significance found for any of the groups when compared to the controls.

The F_1 generation hatching ranged between 72.9% for test level 5 to 94.3% in test level 4. Within replicates success ranged between 46% in level 5 and 100% in level 4. Frequency analysis gave significant reduction in hatch in the F_1 generation at the highest test concentration (Figure 7 of the report).

SURVIVAL

Parental survival is best summarized on Table 8 (copy attached) with survival showing **significant differences from the controls only at the highest concentration of 0.29 ug/l (53%) for the day-7 to 60 post-hatch group.** The to 60 to 120 post-hatch groups as far as day-301 showed no significant differences from the controls although mortality started to increase in the period between 153 to termination at 301 (Table 8).

For the F_1 generation the controls were pooled because frequency analysis and the Fisher's Exact test showed no significant differences. Further, **only at the highest concentration (0.29 ug/l) significant differences in survival were found when compared to the controls after approximately 60 days of post-hatch exposure.**

GROWTH

Standard length and wet weight as measures of growth were not affected at any treatment level in neither the parental nor the filial generation as determined by analysis of variance coupled with Dunnett's one-tailed t-test.

REPRODUCTION

As indicated above, five parameters were used to indicate reproductive success: spawns/pair; number of eggs/pair; eggs/spawn; number of reproductive days and number of eggs/pair/ reproductive day. These parameters were tracked from study day-159 to study day 307.

The total level of spawns, as indicated by ANOVA and Dunnett's one-tailed t-test showed **significant decrease, when compared to controls, in level 2 (0.033 ug/l) for the parental generation while level 4 produced the largest number of eggs (0.14 ug/l). For level 4** no overall statistical significant difference with the controls was observed. The control had the largest number of eggs/spawn.

There was no significant difference between the pooled controls and any of the test levels for the mean number of eggs/spawn in either generation, but the number of spawns and eggs per adult or pair of adults as well as the number of reproductive days were lowest for the 0.033 and 0.29 ug/l (Figures 16 through 22). The solvent control and the 0.29 ug/l treatment level had the lowest eggs/pair/reproductive day (Figure 23).

The greatest number of **reproductive days** (days from the first to the last spawn) was observed in level 1 (0.018 ug/l). None of the test concentrations showed a significant decrease in this parameter.

No significant differences were observed, at any test level, with the controls for the mean number of eggs/pair/reproductive day parameter. For the **parental generation**, mean values for this parameter ranged between a high value of 38.2 for the blank control and a low value of 13.6 for level 5 (0.29 ug/l) - Table 12 - [**a 64% reduction**].

Table 9 summarizes the mean percent hatch, survival, standard length and wet weight results for the F_1. No significant reduction from the pooled controls is noted.

BIOCONCENTRATION

Bioconcentration (BC) increased a little with increased dose but more with extended time of exposure. Maximum BC factors were in the order of 1800 X to 2100 X [no depuration time/level given].

13. STUDY AUTHORS CONCLUSIONS AND QUALITY ASSURANCE MEASURES

According to study authors, **ONLY** the following parameters were significantly affected ($P \leq 0.05$):

Adversely affected ← 11 (For your information)

Hatchability: [For F_1 at the The F0 was not affected].

Survival: Significant differences from the controls only at the highest concentration of 0.29 ug/l for both the F_o and the F_1 at approximately 60-day post-hatch.

Based on the data for this fathead minnow full life-cycle test, the MATC limits for the active ingredient were estimated to be: NOEC = 0.14 ug/l; the LOEC = 0.29 ug/l.

The value of the MATC as the geometric mean of the LOEC and NOEC was calculated to be 0.20 ug/l.

A 96-hour LC_{50} was calculated to be 2.49 ug/l.

Quality assurance and good laboratory practice statements were included in the report indicating adherence to USEPA GLP regulations.

14. REVIEWERS DISCUSSION AND INTERPRETATION OF STUDY RESULTS

A. Test Procedure

The test procedures were generally in accordance with EPA's protocol EPA-600/8/-81-011 of May 1982. No major deviations that may affect the validity of the test were noted.

B. Statistical Analysis

The statistical analysis of ABC Labs. was very thorough and adequate both in methodology and results as determined by random repetition of two of the tests and careful examination and cross-checks of the laboratory's raw data against the final (computer analysis) data.

EEB reran the F_o and F_1 hatchability data, recalculated the T-test for evaluating the validity of pooling the controls and obtained results similar to those of ABC Labs (printouts of these data are attached).

Hatchability: For F_1 at t (0.25 ug/l or 0.25 ppb) hatchability was adv ← FYI hatchability was not affe level. There was no significant difference between the controls for this tests and pooling was found to be acceptable.

Survival of F_o and F_1 was significantly different from controls at the highest exposure of 0.25 ug/l. Fish growth as reflected by standard length and wet weight were not significantly reduced by treatment exposure in either the F_o or F_1.

Length and weight data were analyzed using ANOVA, Dunnett's and Williams tests. There were no significant differences detected between treatment and control groups.

C. Discussion/Results

This study is scientifically sound and meets the guideline requirements for the Life Cycle Toxicity test using the Fathead minnow. The MATC for Cyfluthrin (calculated as the geometric mean of the NOEC and LOEC was determined to be 0.19 ug/l). The NOEC was 0.14 ug/L and the LOEC was 0.25 ug/L. The 96-hour LC_{50} was determined to be 2.49 ug/l.

Since the concentration of the highest level was given as 0.25 ug/l in all raw data tables (as opposed to 0.29 in other places of the report), this reviewer used this value to recalculate statistics and the MATC value.

D. Adequacy of the Study

1) Classification: Core
2) Rationale: N/A
3) Repairability : N/A

15. COMPLETION OF ONE LINER FOR STUDY:

TABLE 8

Hatchability and Survival of Parental Generation Fathead Minnows (*Pimephales promelas*) Exposed to ^{14}C-Cyfluthrin

Mean Measured ^{14}C-Cyfluthrin Concentration (µg/L)	Percent[e] Egg Hatch	Day 7-61[a] Post-Hatch Percent Survival	Day 61-120[b] Post-Hatch Percent Survival	Day 120-153[c] Post-Hatch Percent Survival	Day 153-301[d] Post-Hatch Percent Survival
Control	78.6	93	100	100	62.5
Solvent Control	77.9	92	98.3	100	87.5
Level 1 (0.018 µg/L)	92.1	93	100	100	93.8
Level 2 (0.033 µg/L)	75.7	82.7[f]	96.7	100	93.8
Level 3 (0.065 µg/L)	87.9	91	100	100	100
Level 4 (0.14 µg/L)	89.3	90	91.7	100	100
Level 5 (0.29 µg/L)	88.6	53*	80.0*	97.5	87.5

[a]N = 100; [b]N = 60; [c]N = 40; [d]N = 16; [e]N = 140; [f]N = 75

*Significant reduction from pooled controls.

EEC LABS NO. 33821-48

TABLE 9

Mean Percent Hatch, Survival, Standard Length and Wet Weight of First Fillial (F1) Fathead Minnows (Pimephales promelas) Exposed to ^{14}C-Cyfluthrin

Mean Measured ^{14}C-Cyfluthrin Concentration (µg/L)	Day 0-60 Post-Hatch			
	Percent[a] Hatch	Percent Survival	Standard[b] Length (mm)	Wet[b] Weight (mg)
Control	85.1	91.0	27.4 ± 3.1	427.9 ± 145.2
Solvent Control	91.4	86.0	27.6 ± 3.4	412.9 ± 144.8
Level 1 (0.018 µg/L)	84.3	98.0	28.0 ± 2.1	440.7 ± 107.2
Level 2 (0.033 µg/L)	92.1	98.0	28.0 ± 2.3	413.0 ± 111.0
Level 3 (0.065 µg/L)	91.5	95.0	27.7 ± 2.5	417.2 ± 111.2
Level 4 (0.14 µg/L)	94.3	97.0	26.6 ± 3.4	377.4 ± 133.7
Level 5 (0.29 µg/L)	72.3*	75.0*	28.0 ± 3.4	448.5 ± 149.0

[a]Average of 5-7 sets of 35 eggs.

[b]Mean and standard deviation.

*Significant reduction from pooled controls.

FATHEAD MINNOW LIFE CYCLE 414504-01 FØ HATCHABILITY F0_STRUCT.ST
File: B:F0_HATCH.IN Transform: NO TRANSFORMATION

t-test of Solvent and Blank Controls Ho:GRP1 MEAN = GRP2 MEAN

GRP1 (SOLVENT CRTL) MEAN =	25.5000	CALCULATED t VALUE =	-0.3924
GRP2 (BLANK CRTL) MEAN =	26.7500	DEGREES OF FREEDOM =	6
DIFFERENCE IN MEANS =	-1.2500		

TABLE t VALUE (0.05 (2), 6) = 2.447 NO significant difference at alpha=0.05
TABLE t VALUE (0.01 (2), 6) = 3.707 NO significant difference at alpha=0.01

FATHEAD MINNOW LIFE CYCLE 414504-01 F0 HATCHABILITY
File: B:F0_HATCH.IN Transform: NO TRANSFORMATION

t-test of Solvent and Blank Controls Ho:GRP1 MEAN = GRP2 MEAN

GRP1 (SOLVENT CRTL) MEAN =	25.5000	CALCULATED t VALUE =	-0.3924
GRP2 (BLANK CRTL) MEAN =	26.7500	DEGREES OF FREEDOM =	6
DIFFERENCE IN MEANS =	-1.2500		

TABLE t VALUE (0.05 (2), 6) = 2.447 NO significant difference at alpha=0.05
TABLE t VALUE (0.01 (2), 6) = 3.707 NO significant difference at alpha=0.01

TITLE: FATHEAD MINNOW LIFE CYCLE 414504-01 FØ HATCHABILITY FØ_HATCH.OUT 1/23/95
FILE: B:FØ_HATCH.IN
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	SOLV CTRL	1	26.0000	26.0000
1	SOLV CTRL	2	24.0000	24.0000
1	SOLV CTRL	3	32.0000	32.0000
1	SOLV CTRL	4	20.0000	20.0000
2	BLANK CTRL	1	22.0000	22.0000
2	BLANK CTRL	2	30.0000	30.0000
2	BLANK CTRL	3	25.0000	25.0000
2	BLANK CTRL	4	30.0000	30.0000
3	0.015 LEVEL1	1	30.0000	30.0000
3	0.015 LEVEL1	2	34.0000	34.0000
3	0.015 LEVEL1	3	32.0000	32.0000
3	0.015 LEVEL1	4	30.0000	30.0000
4	0.03 LEVEL2	1	31.0000	31.0000
4	0.03 LEVEL2	2	18.0000	18.0000
4	0.03 LEVEL2	3	29.0000	29.0000
4	0.03 LEVEL2	4	25.0000	25.0000
5	0.06 LEVEL3	1	30.0000	30.0000
5	0.06 LEVEL3	2	32.0000	32.0000
5	0.06 LEVEL3	3	30.0000	30.0000
5	0.06 LEVEL3	4	26.0000	26.0000
6	0.12 LEVEL4	1	26.0000	26.0000
6	0.12 LEVEL4	2	27.0000	27.0000
6	0.12 LEVEL4	3	29.0000	29.0000
6	0.12 LEVEL4	4	30.0000	30.0000
7	0.25 LEVEL5	1	29.0000	29.0000
7	0.25 LEVEL5	2	27.0000	27.0000
7	0.25 LEVEL5	3	34.0000	34.0000
7	0.25 LEVEL5	4	29.0000	29.0000

FATHEAD MINNOW LIFE CYCLE 414504-01 F0 HATCHABILITY
File: B:F0_HATCH.IN Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	SOLV CTRL	4	20.000	32.000	25.500
2	BLANK CTRL	4	22.000	30.000	26.750
3	0.015 LEVEL1	4	30.000	34.000	31.500
4	0.03 LEVEL2	4	18.000	31.000	25.750
5	0.06 LEVEL3	4	26.000	32.000	29.500
6	0.12 LEVEL4	4	26.000	30.000	28.000
7	0.25 LEVEL5	4	27.000	34.000	29.750

FATHEAD MINNOW LIFE CYCLE 414504-01 F0 HATCHABILITY

File: B:F0_HATCH.IN Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	SOLV CTRL	25.000	5.000	2.500
2	BLANK CTRL	15.583	3.948	1.974
3	0.015 LEVEL1	3.667	1.915	0.957
4	0.03 LEVEL2	32.917	5.737	2.869
5	0.06 LEVEL3	6.333	2.517	1.258
6	0.12 LEVEL4	3.333	1.826	0.913
7	0.25 LEVEL5	8.917	2.986	1.493

FATHEAD MINNOW LIFE CYCLE 414504-01 F0 HATCHABILITY
File: B:F0_HATCH.IN Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	121.429	20.238	1.479
Within (Error)	21	287.250	13.679	
Total	27	408.679		

Critical F value = 2.57 (0.05,6,21)
Since F < Critical F FAIL TO REJECT Ho:All groups equal

FATHEAD MINNOW LIFE CYCLE 414504-01 F0 HATCHABILITY
File: B:F0_HATCH.IN Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	SOLV CTRL	25.500	25.500		
2	BLANK CTRL	26.750	26.750	-0.478	
3	0.015 LEVEL1	31.500	31.500	-2.294	
4	0.03 LEVEL2	25.750	25.750	-0.096	
5	0.06 LEVEL3	29.500	29.500	-1.529	
6	0.12 LEVEL4	28.000	28.000	-0.956	
7	0.25 LEVEL5	29.750	29.750	-1.625	

Dunnett table value = 2.46 (1 Tailed Value, P=0.05, df=20,6)

FATHEAD MINNOW LIFE CYCLE 414504-01 F0 HATCHABILITY
File: B:F0_HATCH.IN Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	SOLV CTRL	4			
2	BLANK CTRL	4	6.433	25.2	-1.250
3	0.015 LEVEL1	4	6.433	25.2	-6.000
4	0.03 LEVEL2	4	6.433	25.2	-0.250
5	0.06 LEVEL3	4	6.433	25.2	-4.000
6	0.12 LEVEL4	4	6.433	25.2	-2.500
7	0.25 LEVEL5	4	6.433	25.2	-4.250

FATHEAD MINNOW LIFE CYCLE 414504-01 F0 HATCHABILITY
File: B:F0_HATCH.IN Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	SOLV CTRL	4	25.500	25.500	25.500
2	BLANK CTRL	4	26.750	26.750	26.750
3	0.015 LEVEL1	4	31.500	31.500	28.625
4	0.03 LEVEL2	4	25.750	25.750	28.625
5	0.06 LEVEL3	4	29.500	29.500	28.750
6	0.12 LEVEL4	4	28.000	28.000	28.750
7	0.25 LEVEL5	4	29.750	29.750	29.750

FATHEAD MINNOW LIFE CYCLE 414504-01 F0 HATCHABILITY
File: B:F0_HATCH.IN Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
SOLV CTRL	25.500				
BLANK CTRL	26.750	0.478		1.72	k= 1, v=21
0.015 LEVEL1	28.625	1.195		1.80	k= 2, v=21
0.03 LEVEL2	28.625	1.195		1.83	k= 3, v=21
0.06 LEVEL3	28.750	1.243		1.84	k= 4, v=21
0.12 LEVEL4	28.750	1.243		1.85	k= 5, v=21
0.25 LEVEL5	29.750	1.625		1.85	k= 6, v=21

s = 3.698
Note: df used for table values are approximate when v > 20.

F1-HATCH ANALYSIS

TITLE: FULL LIFE-CYCLE MRID 414504-01 CYFLUTHRIN FISH
FILE: C:\TEMP\F1_HATR.IN
TRANSFORM: NO TRANSFORMATION NUMBER OF GROUPS: 7

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	SOLV CONTRL	1	0.9710	0.9710
1	SOLV CONTRL	2	0.9430	0.9430
1	SOLV CONTRL	3	0.8860	0.8860
1	SOLV CONTRL	4	0.8570	0.8570
2	CONTRL	1	0.9710	0.9710
2	CONTRL	2	0.7710	0.7710
2	CONTRL	3	0.7430	0.7430
2	CONTRL	4	0.8860	0.8860
2	CONTRL	5	0.8860	0.8860
3	LEVEL1	1	0.8000	0.8000
3	LEVEL1	2	0.8000	0.8000
3	LEVEL1	3	0.9140	0.9140
3	LEVEL1	4	0.8570	0.8570
4	LEVEL2	1	0.9140	0.9140
4	LEVEL2	2	0.9710	0.9710
4	LEVEL2	3	0.8290	0.8290
4	LEVEL2	4	0.9710	0.9710
5	LEVEL3	1	0.8860	0.8860
5	LEVEL3	2	0.9430	0.9430
5	LEVEL3	3	0.9430	0.9430
5	LEVEL3	4	0.8860	0.8860
6	LEVEL4	1	1.0000	1.0000
6	LEVEL4	2	1.0000	1.0000
6	LEVEL4	3	0.8000	0.8000
6	LEVEL4	4	0.9710	0.9710
7	LEVEL5	1	0.8290	0.8290
7	LEVEL5	2	0.7710	0.7710
7	LEVEL5	3	0.8570	0.8570
7	LEVEL5	4	0.4570	0.4570

FULL LIFE-CYCLE MRID 414504-01 CYFLUTHRIN FISH
File: C:\TEMP\F1_HATR.IN Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	SOLV CONTRL	4	0.857	0.971	0.914
2	CONTRL	5	0.743	0.971	0.851
3	LEVEL1	4	0.800	0.914	0.843
4	LEVEL2	4	0.829	0.971	0.921
5	LEVEL3	4	0.886	0.943	0.915
6	LEVEL4	4	0.800	1.000	0.943
7	LEVEL5	4	0.457	0.857	0.729

FULL LIFE-CYCLE MRID 414504-01 CYFLUTHRIN FISH
File: C:\TEMP\F1_HATR.IN Transform: NO TRANSFORMATION

SUMMARY STATISTICS ON TRANSFORMED DATA TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM
1	SOLV CONTRL	0.003	0.052	0.026
2	CONTRL	0.009	0.093	0.042
3	LEVEL1	0.003	0.055	0.027
4	LEVEL2	0.005	0.067	0.034
5	LEVEL3	0.001	0.033	0.016
6	LEVEL4	0.009	0.096	0.048
7	LEVEL5	0.034	0.185	0.092

FULL LIFE-CYCLE MRID 414504-01 CYFLUTHRIN FISH
File: C:\TEMP\F1_HATR.IN Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	0.132	0.022	2.444
Within (Error)	22	0.199	0.009	
Total	28	0.331		

Critical F value = 2.55 (0.05,6,22)
Since F < Critical F FAIL TO REJECT Ho:All groups equal

FULL LIFE-CYCLE MRID 414504-01 CYFLUTHRIN FISH
File: C:\TEMP\F1_HATR.IN Transform: NO TRANSFORMATION

DUNNETTS TEST

****** WARNING ******

This data set has unequal replicates. The Bonferroni T-test should be used instead of the Dunnetts test.

FULL LIFE-CYCLE MRID 414504-01 CYFLUTHRIN FISH
File: C:\TEMP\F1_HATR.IN Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	SOLV CONTRL	0.914	0.914		
2	CONTRL	0.851	0.851	0.988	
3	LEVEL1	0.843	0.843	1.066	
4	LEVEL2	0.921	0.921	-0.104	
5	LEVEL3	0.915	0.915	-0.004	
6	LEVEL4	0.943	0.943	-0.425	
7	LEVEL5	0.729	0.729	2.769	*

Dunnett table value = 2.46 (1 Tailed Value, P=0.05, df=20,6)

FULL LIFE-CYCLE MRID 414504-01 CYFLUTHRIN FISH
File: C:\TEMP\F1_HATR.IN Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	SOLV CONTRL	4			
2	CONTRL	5	0.155	17.0	0.063
3	LEVEL1	4	0.164	17.9	0.072
4	LEVEL2	4	0.164	17.9	-0.007
5	LEVEL3	4	0.164	17.9	-0.000
6	LEVEL4	4	0.164	17.9	-0.028
7	LEVEL5	4	0.164	17.9	0.186

FULL LIFE-CYCLE MRID 414504-01 CYFLUTHRIN FISH
File: C:\TEMP\F1_HATR.IN Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	6	0.132	0.022	2.444
Within (Error)	22	0.199	0.009	
Total	28	0.331		

Critical F value = 2.55 (0.05,6,22)
Since F < Critical F FAIL TO REJECT Ho:All groups equal

FULL LIFE-CYCLE MRID 414504-01 CYFLUTHRIN FISH
File: C:\TEMP\F1_HATR.IN Transform: NO TRANSFORMATION

BONFERRONI T-TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	SOLV CONTRL	0.914	0.914		
2	CONTRL	0.851	0.851	0.988	
3	LEVEL1	0.843	0.843	1.066	
4	LEVEL2	0.921	0.921	-0.104	
5	LEVEL3	0.915	0.915	-0.004	
6	LEVEL4	0.943	0.943	-0.425	
7	LEVEL5	0.729	0.729	2.769	*

Bonferroni T table value = 2.59 (1 Tailed Value, P=0.05, df=22,6)

FULL LIFE-CYCLE MRID 414504-01 CYFLUTHRIN FISH
File: C:\TEMP\F1_HATR.IN Transform: NO TRANSFORMATION

BONFERRONI T-TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	SOLV CONTRL	4			
2	CONTRL	5	0.164	17.9	0.063
3	LEVEL1	4	0.172	18.9	0.072
4	LEVEL2	4	0.172	18.9	-0.007
5	LEVEL3	4	0.172	18.9	-0.000
6	LEVEL4	4	0.172	18.9	-0.028
7	LEVEL5	4	0.172	18.9	0.186